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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/692,953	10/24/2003	Jeffrey Bogart	NVLUS.018A	1886

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EXAMINER

WONG, EDNA

ART UNIT	PAPER NUMBER
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1753

SHORTENED STATUTORY PERIOD OF RESPONSE	NOTIFICATION DATE	DELIVERY MODE
3 MONTHS	04/30/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Notice of this Office communication was sent electronically on the above-indicated "Notification Date" and has a shortened statutory period for reply of 3 MONTHS from 04/30/2007.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary

Application No.

10/692,953

Applicant(s)

BOGART ET AL.

Examiner

Edna Wong

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 February 2007 and 06 April 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) 7 and 16-26 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6 and 8-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>March 11, 2004</u> . | 6) <input type="checkbox"/> Other: _____ |

Election/Restrictions

Applicant's election without traverse of Group I, claims **1-6 and 8-15**, specie of electrochemical deposition, in the replies filed on February 16, 2007 and April 6, 2007 are acknowledged.

The requirement is still deemed proper and is therefore made FINAL.

Accordingly, claims **7 and 16-26** are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Specification

The disclosure is objected to because of the following informalities:

page 1, line 9, the word "priority" should be amended to the word -- benefit --.

page 2, line 6, the words -- (not shown) -- inserted after the number "23".

page 3, line 5, the word "pressurebuilding" should be amended to the words -- pressure building --.

page 3, line 18, it is unclear what is meant by the words "before of during".

page 5, line 18, reference character "66" has been used to designate both bubbles and a solution inlet (from page 5, line 2). It is unclear what reference character

"66" designates. See also page 6, lines 2-3.

page 8, line 1, reference character "124" has been used to designate both slits and openings (from page 7, line 29). It is unclear what reference character "124" designates.

page 9, line 27, the words -- ,now US Patent No. 6,535,116, -- should be inserted after the year "2001".

page 9, line 29, the words -- now US Patent No. 6,858,121, -- should be inserted after the number "20020020628".

page 9, line 31, the words -- , now US Patent No. 6,921,551 -- should be inserted after the word "Workpiece".

page 10, line 1, the words -- , now US Patent No. 7,201,829 -- should be inserted after the word "Design".

Appropriate correction is required.

The lengthy specification has not been checked to the extent necessary to

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determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 112

I. Claims 11 and 12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 11

lines 1-2, "the electrochemical processing" lacks antecedent basis.

Claim 12

lines 1-2, "the electrochemical processing" lacks antecedent basis.

II. Claims 11 and 12 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01. The omitted steps are: the electrochemical processing step.

Claim 11

line 1-2, recite "during the electrochemical processing".

Claim 12

lines 1-2, recite "before the electrochemical processing".

The method recited in claim 1, lines 3-9, comprises the steps of placing, flowing, immersing and moving. There is no electrochemical process step recited in the body of claim 1, however, there is an electrochemical process recited in the preamble of claim 1, but it is only recited as an intended use. Thus, the limitations of claims 11 and 12 are further limiting an intended use in the preamble and not the method steps in the body of the claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

I. Claims 1-3, 5-6, 8 and 10-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Kimura et al.** (US Patent Application Publication No. 2001/0024691 A1) in combination with **Wang et al.** (US Patent No. 6,610,189 B2).

Kimura teaches a method for removing gas bubbles from a workpiece **W** (= a semiconductor substrate) [page 15, [0193]] surface which is placed in a process solution (= a plating liquid) [page 15, [0195]] for an electrochemical process (pages 18-

19, [0238]), the method comprising:

(a) flowing the process solution through the one or more openings **2-30** (= plating liquid columns) of a barrier surface **2-22** (= a plating liquid impregnated material) [page 16, [0213]; and Fig. 12];

(b) immersing the workpiece surface **W** into the process solution (= a plating liquid containing Cu ions, which has seeped out of the plating liquid impregnated material **2-22**, is filled into the gap between the plating liquid impregnated material **2-22** and the surface, to be plated, of the semiconductor substrate **W** to apply Cu plating to the surface of the semiconductor substrate **W** (page 15, [0195]; and Fig. 12); and

(c) moving the workpiece surface towards the barrier surface (= as indicated by imaginary lines in FIG. 12, after the plating liquid reaches the upper surface (surface to be plated) of the substrate **W** from the lower surface of the plating liquid impregnated material **2-22** to form the plating liquid columns **2-30**, the substrate **W**, for example, may be instantaneously raised to bring the plating liquid impregnated material **2-22** and the substrate **W** close to each other instantaneously) [page 17, [0218]] to induce a process solution flow between the workpiece surface and the barrier surface to remove gas bubbles from the workpiece surface (= the plating liquid impregnated material **2-22** and the substrate **W** can be instantaneously brought close to each other. With this measure, a rapid outward flow of the plating liquid can be generated to drive out air bubbles together with the plating liquid) [page 17, [0219]].

The method further comprises placing the workpiece surface in proximity of the

barrier surface subsequent to the step of moving (= the gap between the substrate **W** held by the substrate holding portion **2-9** and the plating liquid impregnated material **2-22** reaches about 0.1 to 10 mm) [page 14, [0192]].

The distance between the workpiece surface and the barrier surface is 0.5 to 20 millimeters (= about 0.1 to 10 mm) [page 14, [0192]].

The barrier surface is adapted to have channels **2-30** (= plating liquid columns) to direct and increase the velocity of the flow of process solution between the workpiece surface and the barrier surface (= a flow of the plating liquid **Q**, which advances in a direction perpendicular to the plating liquid introduction pipe **2-28** and spreads over the entire surface of the surface, to be plated, of the substrate **W**) [page 16, [0213]; and Fig. 46].

The electrochemical process is an electrochemical deposition of a conductive material onto the surface of the workpiece (pages 18-19, [0238]).

The method further comprises rotating the workpiece surface during the step of immersing (= the substrate holding portion **2-9** may be rotated at low speed) [page 15, [0195]].

The step of moving occurs before the electrochemical processing is initiated (page 15, [0194] to [0195]).

The workpiece surface and the barrier surface are substantially parallel to one another (Fig. 12).

The method of Kimura differs from the instant invention because Kimura does not disclose the following:

a. Placing a barrier surface having one or more openings into the process solution, as recited in claim 1.

Kimura teaches that a flow of the plating liquid **Q**, which advances in a direction perpendicular to the plating liquid introduction pipe **2-28** and spreads over the entire surface of the surface, to be plated, of the substrate **W** (page 16, [0213]; and Fig. 46).

Like Kimura, Wang teaches mechanically enhancing the deposition of a metal film within a feature. Wang teaches a flow diffuser **71** in the process solution **79**. The electrolyte solution contained within the electrolyte cell above the flow diffuser "spread out" throughout the electrolytic cell (col. 16, line 54 to col. 17, line 21; and Fig. 1).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by Kimura by placing the barrier surface having one or more openings into the process solution because this would have been doing the same endeavor of spreading the electrolyte over the entire surface of the surface to be plated as taught by Wang (col. 16, line 54 to col. 17, line 21; and Fig. 1).

Furthermore, the rearrangement of parts was held to have been obvious. *In re Japiske* 86 USPQ 70 and MPEP § 2144.04(C).

b. Initiating the electrochemical process during the step of immersing, as

recited in claim 10.

c. Wherein the step of moving occurs during the electrochemical processing, as recited in claim 11.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by Kimura by initiating the electrochemical process during the step of immersing; and wherein the step of moving occurs during the electrochemical processing because selection of any order of performing process steps is prima facie obvious in the absence of new or unexpected results. See *In re Burhans*, 154 F.2d 690, 69 USPQ 330 (CCPA 1946).

Furthermore, the method recited in claim 1, lines 3-9, comprises the steps of placing, flowing, immersing and moving. The method is not an electrochemical method, i.e., the method steps required to remove the gas bubbles do not require electrolysis. Thus, there is no relationship between the steps of immersing and moving and the electrochemical processing, which is not a method step in claim 1.

d. Wherein during the step of moving, the flow of process solution has a velocity of 1 to 5 meters per second, as recited in claim 13.

Kimura teaches that air bubbles **B** entrained by this flow of the plating liquid Q are pushed outward, and a front line **Q1** of the flow of the plating liquid **Q** is a nearly straight line, so that the plating liquid **Q** does not enclose air. Thus, the air bubbles are prevented from remaining in the plating liquid filled between the plating liquid

impregnated material **2-22** and the surface, to be plated, of the substrate **W** (page 16, [0214]; and Fig. 46).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the step of moving described by Kimura with wherein during the step of moving, the flow of process solution has a velocity of 1 to 5 meters per second because the flow of the plating liquid **Q** disclosed by Kimura naturally has a velocity. The velocity of the flow of process solution is a result-effective variable and one skilled in the art has the skill to calculate the velocity of the flow of process solution that would have determined the success of the desired reaction to occur, e.g., creating a front line **Q1** of the flow of the plating liquid **Q** that is a nearly straight line, so that the plating liquid **Q** does not enclose air (MPEP § 2141.03).

e. Wherein during the step of moving the workpiece surface is moved towards the barrier surface with a velocity of 10 to 50 millimeters per second, as recited in claim 14.

Kimura teaches that the substrate, for example, may be instantaneously raised to bring the plating liquid impregnated material **2-22** and the substrate **W** close to each other instantaneously (page 17, [0218]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the step of moving described by Kimura with wherein during the step of moving the workpiece surface is moved towards the barrier

surface with a velocity of 10 to 50 millimeters per second because the raising of the substrate disclosed by Kimura naturally has a velocity. The velocity of raising the substrate is not deemed a patentable modification; however, such changes may impart patentability to a process if the ranges claimed produce new and unexpected results which are different in kind and not merely in degree from results of the prior art, such ranges are termed "critical" ranges and Applicant has the burden of proving such criticality; even though Applicant's modification results in great improvement and utility over the prior art, it may still not be patentable if the modification was within capabilities of one skilled in the art; more particularly, where general conditions of the claim are disclosed in the prior art, it is not inventive to discover optimum or workable ranges by routine experimentation. *In re Aller*, 220 F2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) and MPEP § 2144.05.

II. Claims 4 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Kimura et al.** (US Patent Application Publication No. 2001/0024691 A1) as applied to claims 1-3, 5-6, 8 and 10-15 above, and further in view of **Basol et al.** (US Patent No. 7,097,755 B2).

Kimura is as applied above and incorporated herein.

The method of Kimura differs from the instant invention because Kimura does not disclose the following:

a. Touching the barrier surface with the workpiece surface subsequent to the

step of moving, as recited in claim 4.

b. Laterally moving the workpiece surface in proximity of the barrier surface, as recited in claim 9.

Like Kimura, Basol teaches a workpiece surface influencing device (WSID). A WSID 102 having openings 104 in it is disposed in close proximity of a workpiece or wafer 106 to be processed (col. 3, lines 17-21; and Fig. 1A). The surface 113 of the WSID 102 facing the front surface 112 of the wafer is used as the sweeper and the WSID 102 itself established appropriate electrolyte flow and electric field flow to the front surface 112 for globally uniform deposition or etching (col. 3, lines 38-42). During ECMD, the wafer surface is pushed against or in close proximity to the surface of the WSID or vice versa when relative motion between the surface of the workpiece and the WSID results in sweeping of the workpiece surface. Planar deposition is achieved due to this sweeping action (col. 2, lines 59-61).

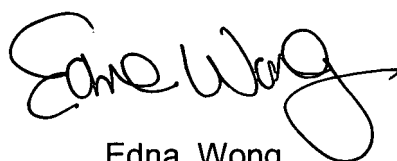
It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by Kimura by touching the barrier surface with the workpiece surface subsequent to the step of moving; and laterally moving the workpiece surface in proximity of the barrier surface because the barrier surface would have acted as a sweeper and planar deposition would have been achieved due to this sweeping action as taught by Basol (col. 2, lines 59-61; and col. 3, lines 17-21 and lines 38-42).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Edna Wong whose telephone number is (571) 272-1349. The examiner can normally be reached on Mon-Fri 7:30 am to 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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A handwritten signature in black ink, appearing to read "Edna Wong". The signature is fluid and cursive, with a long horizontal stroke extending from the end of the word "Wong".

Edna Wong
Primary Examiner
Art Unit 1753

EW
April 24, 2007